edit operations in the query diagram or SQL text view by opening a second window. Changes to the query may cause the data sheet to be refreshed interactively. When data sheet mode is not selected, it may not be refreshed with changes to the other views. Rows are loaded into the datasheet when they come into view.

[0065] The user adds blocks to a query diagram by selecting them from the data tab of the World Manager or from the Insert menu. Blocks are connected by clicking on the output port of the source block and the input port of the target block. Alternatively, blocks can be connected by dragging the mouse from one of the ports to the other with a resulting "rubber-banding" connection line displayed until the user releases the mouse button. In either case, the cursor may be changed between port selection actions to denote the connection operation.

[0066] The SQL view allows arbitrary SELECT queries to be created and edited. It also allows editing of the expression generated by the diagram editor. However, if the SQL is edited, the diagram may no longer be available. In this case, a confirmation dialog may be displayed to warn the user.

[0067] The world editor provides two views for interacting with the virtual world: a structure view and a pseudocode view. The world structure window displays a hierarchical view of the organization for a complete world. Each box under the World root box corresponds to a scene. Boxes beneath the scenes correspond to data elements or other scenes connected by wormholes. Double clicking on any of these boxes may open the corresponding scene or data element editor. The links between boxes represent hierarchy in the world scene tree.

[0068] A box may have one child box for each data source and wormhole contained in its graphical content. Depending on the structure of a world, the depth of the tree may be infinite. For example, if a scene contains a wormhole to another scene which in turn contains a wormhole back to the first, the tree may contain an infinite vertical sequence of the first and second scene. As a result, the tree may only expand a level when explicitly expanded by the user.

[0069] Each link and the box(es) underneath it may be displayed or hidden by clicking on the button at the top of the link. When initially displayed, the world box may be expanded to display all scenes contained by the world. As boxes are expanded, the tree structure may adapt to make room for newly-exposed boxes.

[0070] The parameterization of a world is also displayed in the structure diagram. Global parameters, scene parameters, and query parameters are displayed as text boxes which extend to the left of the box denoting their role as inputs, while query columns are displayed as text boxes which extend to the right of the box denoting their role as outputs. As parameters and column names are added, deleted or modified in other editor windows, the boxes are updated to reflect the change.

[0071] When a scene or query parameter is set to a parameter or column higher in the hierarchy, the parameter's text box is shown "wired" to the source value. These connections can be edited in the structure diagram. To establish a new connection and set the value of a parameter, the input connection point for the parameter and the output connection point for the source parameter or column are clicked with the mouse (in either order). Alternatively, connection points can be connected by dragging the mouse from one to the other with a resulting "rubber-banding" connection line displayed until the user releases the mouse button. In either case, the cursor may changed between selection actions to denote the connection operation. Note that the source must exist higher in the tree hierarchy for a valid connection to be established. To eliminate the link, the user selects the link and then presses the delete key.

[0072] The pseudocode view provides a read-only view of the entire contents of a world in text format. The pseudocode may display an initial header consisting of the world name and the initial scene, followed by the following sections:

[0073] Global parameters

[0074] User classes

[0075] Colormaps

[0076] Color sequences

[0077] Stock images

[0078] Database connections

[0079] Data sources

[0080] Scenes

[0081] In one implementation, sections are surrounded by a pair of dashed lines as follows:

[0082] SectionName:

[0083] In addition, data sources and scenes are separated by a single separator line:

[0084] The succeeding sections display the format for each pseudocode element. Note that square brackets ('[' and ']') denote optional text, vertical separators ('|') denote alternatives.

```
Global parameter format
    DataType ParamName [ (Built-in) ]
        Description:        Description
        Default value:      (None) | Value
        Access:             [Private | Public]
User class format
    ClassName
        Parent classes:
                            (None) | ParentClass1
                            . . .
                            [ParentClassN]
Colormap format (discrete colors):
    ColormapName
        Discrete colors:
        ColormapName (below BL) = valueL [ (ColorName) ]
        . . .
        ColormapName (Bi – Bi + 1) = valuei [ (ColorName) ]
        . . .
        ColormapName (above BU) = valueU [ (ColorName) ]
Colormap format (blended colors):
    ColormapName
        Continuous colors (blended):
        ColormapName (below BL) = valueL [ (ColorNameL) ]
        . . .
        ColormapName (Bi) = valuei [ (ColorNamei) ]
        . . .
        ColormapName (above BU) = valueU [ (ColorNameU) ]
Color sequence format:
    ColorSeqName
        ColorSeqName [0] = valueo [ (ColorNameo) ]
        . . .
```